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Special report ... relative to the decay of teeth  
resulting from a lack of fluorine. 1947.

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The Commonwealth of Massachusetts. Dept. of Public  
Health.

## SPECIAL REPORT

OF THE

DEPARTMENT OF PUBLIC HEALTH

RELATIVE TO

### THE DECAY OF TEETH RESULTING FROM A LACK OF FLUORINE

MAR 12 '51

UNDER CHAPTER 38 OF THE RESOLVES OF 1945 AND CHAPTER 51  
OF 1946

DECEMBER, 1946

BOSTON  
WRIGHT & POTTER PRINTING CO., LEGISLATIVE PRINTERS  
32 DERNE STREET  
1947

No. 1783

U. S. GOVERNMENT PRINTING OFFICE

# SPITOTAL REPORT

OF THE

DEPARTMENT OF PUBLIC HEALTH

REPORT NO.

THE DECAY OF THE RESULTING FROM

THE FLUORINE

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## The Commonwealth of Massachusetts

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### SPECIAL REPORT OF THE DEPARTMENT OF PUBLIC HEALTH RELATIVE TO THE DECAY OF TEETH RESULTING FROM A LACK OF FLUORINE.

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*To the General Court of Massachusetts.*

In accordance with the authority delegated to it by chapter 38 of the Resolves of 1945, the Department of Public Health began a study relative to the decay of teeth resulting from a lack of fluorine in September, 1945, when the funds authorized by the resolve became available. Because the resolve called for a final report in December, 1945, expenditure of funds to carry on the study ceased on the date of the submission of the report.

In the preliminary report (House Bill No. 1608) of December, 1945, all of the information which could be gathered within a short time upon the prevalence of dental caries in Massachusetts and the research work which has been carried out in this State and in other States was presented.

It was pointed out that dental caries is a disease which affects 90 per cent of our population by the time they reach ten years of age and that Massachusetts citizens were spending a number of million dollars per year merely to repair the damages produced by the decay of teeth. A problem of this magnitude justifies the expenditure of funds to study any method by which the annual inroads of this disease can be reduced.

It was pointed out in the report that there is a higher prevalence of dental decay in Massachusetts and other New England States than in most of the other parts of our country which makes the problem a very pressing one to us. Further confirmation of this fact is given in Chart I and Table VI of the Report of the Division of Dental Health, which is attached. The encouraging re-

ports on the use<sup>of</sup> of fluorine to halt the progress of decay led to the study of the fluorine content of the waters of Massachusetts which brought to light the fact that most of them contained only exceedingly small quantities of fluorine and none of them contained as much as one part per million, a level which has been shown in various studies to be necessary to exert any beneficial effect upon retarding the development of dental caries. For this reason it seems evident that fluorine or some other beneficial agent must be added to our water supplies or applied in preparations which come in contact with the teeth if our citizens are to be prevented from suffering from this highly prevalent disease.

Because the General Court saw fit to appropriate funds in the supplementary budget for the establishment of a Division of Dental Health in the Department, personnel was available to carry on some of the features of the investigation which did not involve the expenditure of funds for expenses, pending authorization by the General Court to use the unexpended balance in carrying on the study further. This authorization was requested at the beginning of the legislative year, but was not obtained until June 6, 1946, with the passage of chapter 51 of the Resolves of 1946, which reads as follows:

*Resolved*, That the time within which the department of public health shall make to the general court a report of its investigation and study, under chapter thirty-eight of the resolves of nineteen hundred and forty-five, relative to the decay of teeth resulting from a lack of fluorine, is hereby extended to the second Wednesday in December in the year nineteen hundred and forty-six. For the purposes aforesaid, said department may expend the unexpended balance of the amount appropriated by item 2002-21 of section two of chapter seven hundred and thirty-six of the acts of nineteen hundred and forty-five, but before incurring any expenses the department shall from time to time estimate the amount required and shall submit the same to the governor and council for their approval and no expenses shall be incurred beyond the amount so estimated and approved.

The studies which were being carried on last year have been continued as far as possible with the personnel available. During the year preliminary tabulations have

been made on three studies in which sodium fluoride was added to dental cleaning preparations. These tabulations do not indicate as marked a beneficial effect from fluorine as was found in the studies in Brockton, Cambridge and Millville mentioned in the report of last year. Attention should be called to the fact, however, that these studies compared a group of children whose teeth were being cleaned with pastes containing fluorine with another group in the same schools whose teeth were being cleaned with pastes without fluorine. In the previous studies the comparison had been between half of the mouth in which fluorine was used and the other half in which it was not used. Individual variations in the children and other factors which have not yet been evaluated may account for the apparent difference in beneficial effects in the later studies. Further study of our data is necessary before a final decision can be reached. This involves putting all of the observations on punch cards and sorting them mechanically.

In another study examinations after one year of using fluorine in a mouth wash have been made but analyses of the results have not been carried out.

Also in a study in which a lead fluoride solution was applied to the teeth after routine prophylactic cleaning, examinations after one year of treatment have been made but not yet evaluated.

During the year the following new projects have been started in the State:

In Brockton a study has been set up to determine the effect of adding sodium fluoride to tooth paste. There are 240 children in the group, half of whom receive a tooth paste which does not contain sodium fluoride.

In Belmont a comparative study has been set up, in which indium nitrate is applied topically to the teeth of one group of children and sodium fluoride to the teeth of another group, in both instances after routine cleaning by a dental hygienist.

In addition a study is being carried on with private funds administered by Tufts Dental School in which a comparison is being made of the use of sodium fluoride

in lozenges which are allowed to dissolve in the mouth so that the fluorine can come in contact with the teeth, and sodium fluoride given in pills so that any action which may result will come from the internal effects of the chemical.

Steps have also been taken to measure the value of adding the fluorine to water supplies. The chemical is being added to the water supply of the Belchertown State School and any effect in retarding the development of the caries of those in the school will be measured. Fluorine will be added to the water supply of the Wrentham State School and also solutions of sodium fluoride will be applied directly to the teeth of some of the children residing in the institution. This will make it possible to determine if fluorine used in both ways is superior to its use in the water supply alone. Children in the Fernald State School will not receive fluorine either in the water supply or applied locally but will be examined to determine if decay develops any more rapidly than among the children in the other two schools. It is not expected that any measurable results in these studies will be obtained in less than two or three years and the study should be continued until a definite decision can be made in regard to the usefulness of fluorine.

In setting up any projects to measure the effect of fluorine proposed in the plans for the continuation of this study, it must be kept in mind that only such new projects as could be carried on by the Department on its regular budget after December of this year could be planned, since the expenditure of funds made available by chapter 51 of the Resolves of 1946 must cease at that time.

In the attached report of the Division of Dental Health will be found a résumé of new programs which have been initiated in other States during the past year.

Although a great deal of research work is now being carried on, directed toward discovering measures which will decrease the decay of teeth, no simple easily applied method which is universally effective has yet been brought forward. Before the Department can recommend wholeheartedly the use of any procedure or any material for

this purpose, we must be certain that what is recommended will actually exert a beneficial effect without any undesirable effect. In order to hasten the time when a solution to this urgent problem can be reached, the Department has the responsibility of carrying on investigative work which will determine if procedures found effective elsewhere will be just as effective in this State, where food habits, chemicals in foods and water and other factors may directly influence the usefulness of such a procedure. It is evident that, in a problem as important and complicated as dental decay, worthwhile studies cannot be set up and concluded within a year or a portion of a year. For this reason the Department of Public Health is not requesting a special resolve at this time to continue this study. We are, however, making a request in our regular budget to make the Division of Dental Health permanent and to increase its personnel to a sufficient number to make an adequate study of the prevention of dental caries.

Since dental caries is costing the citizens of Massachusetts several million dollars every year and since we are one of the States with the highest prevalence of dental caries which has been demonstrated by selective service data and confirmed by this study, we are convinced that the appropriation of funds for a study of dental caries by the Division of Dental Health is one of the most worthwhile projects that the Great and Honorable General Court of Massachusetts can authorize.

Respectfully submitted,

VLADO A. GETTING,

*Commissioner.*

WILLIAM H. GRIFFIN,

GORDON HUTCHINS,

FRANCIS H. LALLY,

RICHARD M. SMITH,

JAMES L. TIGHE,

CHARLES F. WILINSKY,

*Members, Public Health Council.*

## STUDY RELATIVE TO THE DECAY OF TEETH.

ACCOUNT No. 2002-21.

DEPARTMENT OF PUBLIC HEALTH,  
STATE HOUSE, BOSTON, December 9, 1946.

1946 appropriation balance available in fiscal year of 1947	\$11,362 00
Less expenditures to date	3,514 11
Cash balance, December 9, 1946	\$7,847 89
Less encumbrances (see below)	4,414 36
Unencumbered appropriation balance, December 9, 1946	\$3,433 53

*Outstanding Encumbrances.*

## D37847 Consultant service:

Dr. J. F. Roberts	\$100 00
Dr. James Springer	40 00
Dr. Basil G. Bibby	98 00
Dr. Abraham E. Nizel	96 00
Dr. James Springer	80 00
Dr. Basil G. Bibby	92 00
Dr. James Springer	60 00
	\$566 00

## D37848 Items, no purchase order:

Royal Transportation Co.	\$0 82
Capitol Transportation Co.	1 05
J. Russell & Co., Inc.	73
Oakes Electrical Supply Co.	15 01
Oakes Electrical Supply Co.	8 73
Collins Plumbing Supply Co.	6 00
	32 34

D37849 Purchasing Bureau, Supply Division —  
requisitions in Transit and Purchasing Bureau:

S-2021 (estimated)	\$14 75
S-2018 (estimated)	25 00
S-2041 (estimated)	183 75
S-2042 (estimated)	131 25
S-2023 (estimated)	15 00
S-2043 (estimated)	740 00
	1,109 75

D37850	Estimated travel of Dr. Bibby and Dr. Corbman	\$410 00
322366	Owens Brush Co. . . . .	39 25
322032	International Business Machines Corp. . .	6 00
306630	J. J. Crimmings Co. . . . .	1,466 04
310065	Proportioneers, Inc. . . . .	771 50
320101	Ward's . . . . .	8 98
320099	Blake & Rebhan . . . . .	90
316127	Ward's . . . . .	3 60
		<hr/>
		\$4,414 36

SPECIAL REPORT OF THE ACTING DIRECTOR  
OF THE DIVISION OF DENTAL HEALTH  
RELATIVE TO THE DECAY OF TEETH RE-  
SULTING FROM A LACK OF FLUORINE.

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DECEMBER 11, 1946.

TO DR. VLADO A. GETTING, *Commissioner of Public Health.*

DEAR SIR:— Herewith is submitted a report of the continuation of a study begun last year by members of this Division and the Division of Sanitary Engineering at your direction, in co-operation with several agencies of the Commonwealth, including Tufts Dental College, the Massachusetts Dental Society, the Department of Mental Health, the Boards of Health, the School Superintendents and others in local communities, as authorized under the provisions of chapter 51 of the Resolves of 1946.

The Department wishes to acknowledge with gratitude the assistance of Dr. Basil G. Bibby, Chief Consultant, in planning our dental caries program, and of Dr. Roy F. Feemster, Director, Division of Communicable Diseases, in the formulation of the study and the report.

**Research Projects in Massachusetts.**

CONTINUATION OF PROJECTS IN OPERATION LAST YEAR.

*1. Fluorine in Cleaning Preparations.*

(a) Two reports on studies begun prior to the passage of the resolve authorizing this study have now appeared in print. These studies were made in children 6 to 15 years of age in Millville and 6 to 14 years of age in Cambridge. A 1 per cent sodium fluoride solution added to the pumice-hydrogen peroxide paste was used in cleaning the teeth in half of the mouth of each child. The teeth

on the other side were cleaned with a paste which contained no sodium fluoride. An overall reduction in new caries of 25 per cent was found when two dental prophylaxes were given to 95 Millville children. Caries were reduced by 43 per cent when three dental prophylaxes were given to 47 Cambridge children. It is not believed that the difference in results is necessarily due to the number of treatments given. In both instances, caries reduction in the upper teeth was much greater than in the lower teeth. The Millville study was carried on by the Department. The Cambridge study, by Tufts Dental College.

(b) Preliminary tabulations of three other studies on the use of sodium fluoride in prophylaxis pastes have been made. The children in the study in Pittsfield were examined to determine the number of decayed, missing and filled teeth and were divided into two groups. One group received a single dental prophylaxis containing 1 per cent sodium fluoride. The other group received a single dental prophylaxis without fluorine. Each of the groups was examined one year later to determine the number of decayed, missing and filled teeth. The study carried on in the South Shore towns — Sandwich, Bourne, Wayland, Sudbury and Sherborn — was similar to the Pittsfield study except that there were two prophylaxes between the preliminary and the final examination. In the Worcester study three prophylaxes were given between the preliminary and the final examination. The preliminary tabulation of the comparison between the prevalence of caries before and after the prophylaxes is given in Table I.

TABLE I. — *Summary of Fluorine Prophylaxis Study on Permanent Teeth by Age, Community and DMF<sup>1</sup> Rates.*

Age.	COMMUNITIES.	UNTREATED.						TREATED.						Per Cent of Im- prove- ment 1945-46.		
		Num- ber of Chil- dren.	1945.		1946.		DMF Differ- ence.	Per Cent of In- crease.	DMF Differ- ence.	Per Cent of In- crease.	1945.		1946.			
			DMF Teeth.	DMF Rate.	DMF Teeth.	DMF Rate.					DMF Teeth.	DMF Rate.	DMF Teeth.		DMF Rate.	
7	South Shore	9	22	2.44	34	3.77	1.33	55	8	20	2.50	30	3.75	1.25	50	5
7	Pittsfield	23	49	2.13	76	3.30	1.17	55	10	30	3.00	39	3.90	.90	30	25
7	Worcester	7	14	2.00	14	2.00	.00	0	17	61	3.59	77	4.53	.94	26	-26
	Total	39	85	2.13	124	3.13	1.00	46	35	111	3.17	146	4.17	1.00	32	14
8	South Shore	30	95	3.17	142	4.73	1.56	49	32	103	3.38	153	4.78	1.40	41	8
8	Pittsfield	79	243	3.08	290	3.67	.59	19	93	245	2.63	355	3.82	1.19	45	-26
8	Worcester	78	284	3.64	356	4.56	.92	25	85	305	3.59	355	4.18	.59	16	9
	Total	187	622	3.33	788	4.21	.88	26	210	658	3.13	863	4.11	.98	31	-5
9	South Shore	41	171	4.17	277	6.76	2.59	62	36	162	4.50	241	6.69	2.19	49	13
9	Pittsfield	68	280	4.12	356	5.24	1.12	27	68	275	4.04	332	4.88	.84	21	6
9	Worcester	85	317	3.73	394	4.64	.91	24	88	392	4.45	492	5.43	1.03	23	1
	Total	194	768	3.96	1,027	5.29	1.33	34	192	829	4.32	1,055	5.49	1.17	27	7
10	South Shore	10	62	6.20	101	10.10	3.90	63	21	83	3.95	128	6.10	2.15	54	9
10	Pittsfield	15	79	5.27	119	7.93	2.66	50	22	110	5.00	132	6.00	1.00	20	30
10	Worcester	49	232	4.73	289	5.90	1.17	25	26	147	5.65	172	6.62	.97	17	8
	Total	74	373	5.04	509	6.83	1.84	36	69	340	4.93	432	6.26	1.33	27	9
11	Pittsfield	7	48	6.86	60	8.57	1.71	25	9	37	4.11	52	5.78	1.67	41	-16
11	Worcester	15	94	6.27	113	7.53	1.26	20	8	43	5.38	56	7.09	1.62	30	-10
	Total	22	142	6.45	173	7.86	1.41	22	17	80	4.71	108	6.35	1.64	35	-13
	Grand Total	516	1,990	3.86	2,621	5.08	1.22	32	523	2,018	3.86	2,604	4.98	1.12	29	3

<sup>1</sup> Decayed, missing and filled teeth.

It will be seen from this table that the reduction in dental caries in the treated group was not as striking as in the studies in Millville and Cambridge. In the grand total for all three studies there was an overall increase in dental caries in the untreated group of 32 per cent compared with a 29 per cent increase in the treated group — a reduction of only 3 per cent in dental caries. Furthermore, it will be noted that the Worcester group which received 3 prophylaxes is not consistently better than the South Shore group which received two prophylaxes or the Pittsfield group which received only one.

Because the number of children in each age group is small, some of the variations may be due to the fewness of the observations. For this reason, in Table II all of the age groups have been combined. It will be noted that in Pittsfield, where one prophylaxis was given, the development of new caries was approximately the same in the treated and untreated groups. In the South Shore study, in which two prophylaxes were given, there was approximately a 10 per cent reduction in the development of newly decayed teeth. In the Worcester study, in which three prophylaxes were given, there was no reduction in the development of caries.

TABLE II. — *Reduction in Dental Caries by Fluorine in Dental Cleaning Pastes with One, Two and Three Prophylactic Treatments.*

SODIUM FLUORIDE IN PUMICE PASTE.								
COMMUNITY.	Number of Prophylaxes.	Number of Children in Study.	Total DMF <sup>1</sup> Teeth Preliminary Examination.	Average DMF Per Child.	Total DMF Final Examination.	Average DMF Per Child.	Increase in DMF Teeth in Period.	Per Cent Increase in DMF Teeth.
Pittsfield . . . . .	1	202	697	3.45	910	4.50	1.05	30.4
South Shore . . . . .	2	97	373	3.84	552	5.69	1.85	48.7
Worcester . . . . .	3	224	948	4.23	1,142	5.09	0.86	20.9
NO SODIUM FLUORIDE IN PUMICE PASTE.								
Pittsfield . . . . .	1	192	699	3.64	901	4.69	1.05	28.9
South Shore . . . . .	2	90	350	3.89	554	6.16	2.27	58.4
Worcester . . . . .	3	224	941	4.02	1,166	4.98	0.96	21.1

<sup>1</sup> Decayed, missing and filled teeth.

The reasons for the failure to obtain the greater beneficial effects are not readily apparent. It may be that, when a more detailed analysis of these studies has been carried out, further light will be thrown upon the reasons for some of the inconsistencies in Table I. It will be noted that in some of the groups there was a greater increase of dental caries in the treated group than in the untreated group. It should also be pointed out that there is some reason to believe that in order to achieve consistent results, it may be necessary that more than three prophylaxes be given.

In comparing the studies in Millville and Cambridge with those in Pittsfield, the South Shore and Worcester, it should be pointed out that in the latter studies the comparison is between dental caries occurring in two separate groups of children, one of which is treated and the other untreated, whereas, in the former studies the comparison is between the dental caries occurring in the treated and untreated sides of the mouths of the same children. Individual variations between children play a much more important part when the control is a separate group of children than when the control is the other side of the same child's mouth. The only way by which such individual variations can be compensated for is by increasing the total number of children studied in this manner.

It must also be pointed out that these studies were begun in 1944 and that under the pressure of activities due to the war the studies could not be as well supervised as might be desired. The prophylaxes were not spaced at as regular intervals in some instances as had been planned and other variables crept into the studies which may have had a bearing on the final outcome. Before we can be thoroughly convinced that there is not some demonstrable difference between one, two and three prophylaxes containing sodium fluoride, further studies greatly increasing the sizes of the groups to be analyzed must be carried out.

## 2. Topical Applications.

There have been many reports on fluorine applied topically in the form of sodium fluoride. In order to compare the effect of another salt base, the Division decided to study the effect of fluorine administered topically in the form of lead fluoride. With the co-operation of the local boards of health and the superintendent of schools in Medford, a study of lead fluoride applied topically has been made in 120 children 10 to 13 years of age. The final examinations, after the series of treatments, have been made, but the punch card analysis of the results will not be available until later.

## 3. Mouth Washes.

In a study by Doctor Bibby *et al* of Tufts Dental College it was reported that the use, thrice weekly, of an acid (pH4) mouth wash containing 0.1 per cent sodium fluoride for one year did not reduce caries activity in 31 dental students below that of 15 students using a control fluoride-free mouth wash, or 39 students using no mouth wash. However, it is stated, there is accumulating evidence to suggest that fluorides are effective in reducing dental decay only when brought in contact with teeth which have fairly recently erupted into the mouth. Thus, a satisfactory test of the effects of fluoride mouth washes must be carried out on a large group of individuals of younger age than those used in this study.

In Medford, in a study on the use of sodium fluoride in mouth washes in a group of 500 children 6 to 15 years of age, the examinations of the teeth at the end of period of use of the mouth washes have been made but the analysis of the results has not been completed.

## NEW PROJECTS IN MASSACHUSETTS.

### 1. Fluorine in Dentifrices.

In Brockton a study was set up during the year on the effect of fluorine incorporated in dentifrices for the reduction of dental decay. One hundred and twenty school

children 10 to 13 years of age were selected to use tooth paste containing fluorine and 120 children of a similar age group, to use tooth paste without fluorine, were chosen as controls. In order to properly evaluate the exact rôle which fluorine plays under these circumstances, it is necessary to determine the availability for action of the fluoride in dentifrices of varying compositions. This project is scheduled to last for 3 to 5 years and is being conducted with the co-operation of the local board of health, the superintendent of schools and civic organizations within the community.

A test of the effect of dentifrices containing fluorine on dental caries was conducted by Doctor Bibby previously on children at St. Vincent's Orphanage and at the Home for Catholic Children in Massachusetts and on students at Tufts Dental School under private sponsorship. No evidence in the reduction of caries activity was found. This result was not unexpected in the older individuals in the study but was contrary to expectations among the children's group in view of the caries reduction which has been obtained in children with topical applications of sodium fluoride. A possible explanation of these results may be the lack of proper supervision of the children's home toothbrush technique. However, adequate supervision is being provided for the study now in progress in Brockton. It is possible that with the proper controls and the new evidence that the application of sodium fluoride on interproximal spaces and occlusal surfaces of teeth with the proper number of applications will prove more effective as a caries control method.

## *2. Topical Applications of Chemical Agents.*

A second project using indium nitrate, as a substitute for the fluorine salts in topical applications, has been started with 250 children at the Daniel Butler School in Belmont. The indium nitrate is being used on selected school children in the form of topical applications after the teeth are cleaned by the dental hygienist. For comparison another group in the dental clinic of Belmont is

receiving topical applications of sodium fluoride after dental prophylaxes. This study is under the supervision of the Chief Dental Consultant, assisted by dental hygienists and field consultants of the Division of Dental Health. It will take at least two years before an evaluation can be obtained on this study.

### *3. Fluorine in Lozenges and Pills.*

A study has been set up in an attempt to throw new light upon whether the most important beneficial effect of fluorine is locally when it comes in contact with the external surfaces of the teeth or whether it is from the internal action after the fluorine has been absorbed and carried to the teeth by the blood stream. This experiment is under private sponsorship with funds administered by Dr. Bibby of the Tufts Dental College. The Department had given some assistance in laying the ground work early in the study before the private funds were made available.

In this study, one group of children is receiving lozenges containing fluorine. These lozenges melt slowly in the mouth and it is supposed that the fluorine is liberated so that it can come in contact with the tooth surface. The action should be prolonged because of the slow melting of the lozenge. Another group is receiving a specially coated pill which does not dissolve in the mouth or stomach. Therefore, any effect of the fluorine from the pill must of necessity be by systemic action alone.

### *4. Fluorine added to Water Supplies.*

In seeking a stable population of children where a study could be set up to evaluate the possible beneficial effects of adding fluorine to the water supply, it appeared that the most suitable groups were those residing in the feeble-minded institutions of the State. A tentative outline of a study using these groups was drawn up and submitted to the Department of Mental Health for consideration by the Committee on Research Projects of that Department. This Committee referred the proposal to the su-

perintendents and the dentists of the three institutions after a conference with representatives of the Department in which all of the details on how the projects would function were discussed. The superintendents and the members of the Research Projects Committee decided that the study was a suitable one to be undertaken.

When authorization for the continuation of this study was received in June, the project in these three institutions was begun.

TABLE III. — *Prevalence of Dental Caries, Wrentham State School.*

PRELIMINARY EXAMINATION.

AGE.	Number of Children examined.	Number of Decayed, Missing and Filled Teeth.	Average DMF <sup>1</sup> Per Child.
6 . . . . .	3	1	0.33
7 . . . . .	7	5	0.71
8 . . . . .	9	7	0.78
9 . . . . .	15	15	1.00
10 . . . . .	10	12	1.20
11 . . . . .	19	53	2.79
12 . . . . .	21	82	3.90
13 . . . . .	34	167	4.91
14 . . . . .	26	130	5.00
15 . . . . .	14	107	7.64
16 . . . . .	12	98	8.17
Total . . . . .	170	677	3.98

<sup>1</sup> Decayed, missing and filled teeth.

TABLE IV. — *Prevalence of Dental Caries, Waverley-Fernald School.*

## PRELIMINARY EXAMINATION.

AGE.	Number of Children examined.	Number of Decayed, Missing and Filled Teeth.	Average DMF <sup>1</sup> Per Child.
7 . . . . .	1	0	0.00
8 . . . . .	9	20	2.22
9 . . . . .	7	20	2.86
10 . . . . .	18	37	2.06
11 . . . . .	31	87	2.81
12 . . . . .	30	110	2.82
13 . . . . .	28	122	4.36
14 . . . . .	28	162	5.79
15 . . . . .	29	174	6.00
16 . . . . .	38	209	5.50
17 . . . . .	1	3	3.00
Total . . . . .	229	944	4.12

<sup>1</sup> Decayed, missing and filled teeth.TABLE V. — *Prevalence of Dental Caries, Belchertown State School.*

## PRELIMINARY EXAMINATION.

AGE.	Number of Children examined.	Number of Decayed, Missing and Filled Teeth.	Average DMF <sup>1</sup> Per Child.
6 . . . . .	1	0	0.00
7 . . . . .	6	5	0.83
8 . . . . .	12	14	1.17
9 . . . . .	9	11	1.22
10 . . . . .	13	27	2.08
11 . . . . .	24	85	3.54
12 . . . . .	32	126	3.94
13 . . . . .	16	52	3.25
14 . . . . .	34	216	6.35
15 . . . . .	26	159	6.12
16 . . . . .	26	207	7.96
Total . . . . .	199	902	4.53

<sup>1</sup> Decayed, missing and filled teeth.

With the assistance and co-operation of the dentists and dental hygienists of the three institutions, a preliminary examination was carried out on all of the children who are to be used as an index in the study. The number of decayed, missing and filled teeth found in these examinations is given in Tables III, IV and V. It will be noted that there was very little difference in the amount of caries in the three groups, the DMF rates being 3.98, 4.12 and 4.53. The further details of the project are indicated in the following plan: —

In the Belchertown State School one part per million of sodium fluoride is being added to the water supply in order to determine the effect of raising the concentration of the chemical to the level usually accepted as one which produces beneficial results. In the Wrentham State School the same amount of sodium fluoride is to be added to the water supply, and at the same time each child included in the study will have a 1 per cent sodium fluoride solution applied to the teeth after they have been cleaned by the dental hygienist. This will measure both the effect of increasing the fluorine concentration in the water supply and the local application of fluorine.

In the Fernald State School no fluorine will be added to the water supply nor will applications be made to the teeth. This school will, therefore, serve as a control. It should be possible to measure the difference in beneficial effects obtained from the use of fluorine by carefully following the development of caries in these three schools.

The equipment necessary to apply the sodium fluoride to the water supply of the Belchertown State School and the Wrentham State School has been installed and the application of the chemical has been started. It is expected that any measurable effects of this study will not become apparent until two or three years have elapsed. The study should be continued until a satisfactory evaluation of this method of the use of fluorine can be obtained.

## EXAMINATION OF CHILDREN IN THE STATE.

*Dental Caries Prevalence in Massachusetts.*

Last year examinations of the teeth of more than 2,000 children between the ages of 6 to 15 were made in Massachusetts in connection with this study. In comparing the data from these examinations with that accumulated by the United States Public Health Service in other States (Chart I and Table VI) it can be seen that children in Massachusetts suffer from a higher prevalence of decayed, missing and filled teeth for each age group than do children in Maryland and California. This is merely further confirmation of statements in regard to the high incidence of dental caries in New England made in the report of December, 1945.

TABLE VI. — *Comparison of Dental Caries Prevalence in Massachusetts and Other States.*

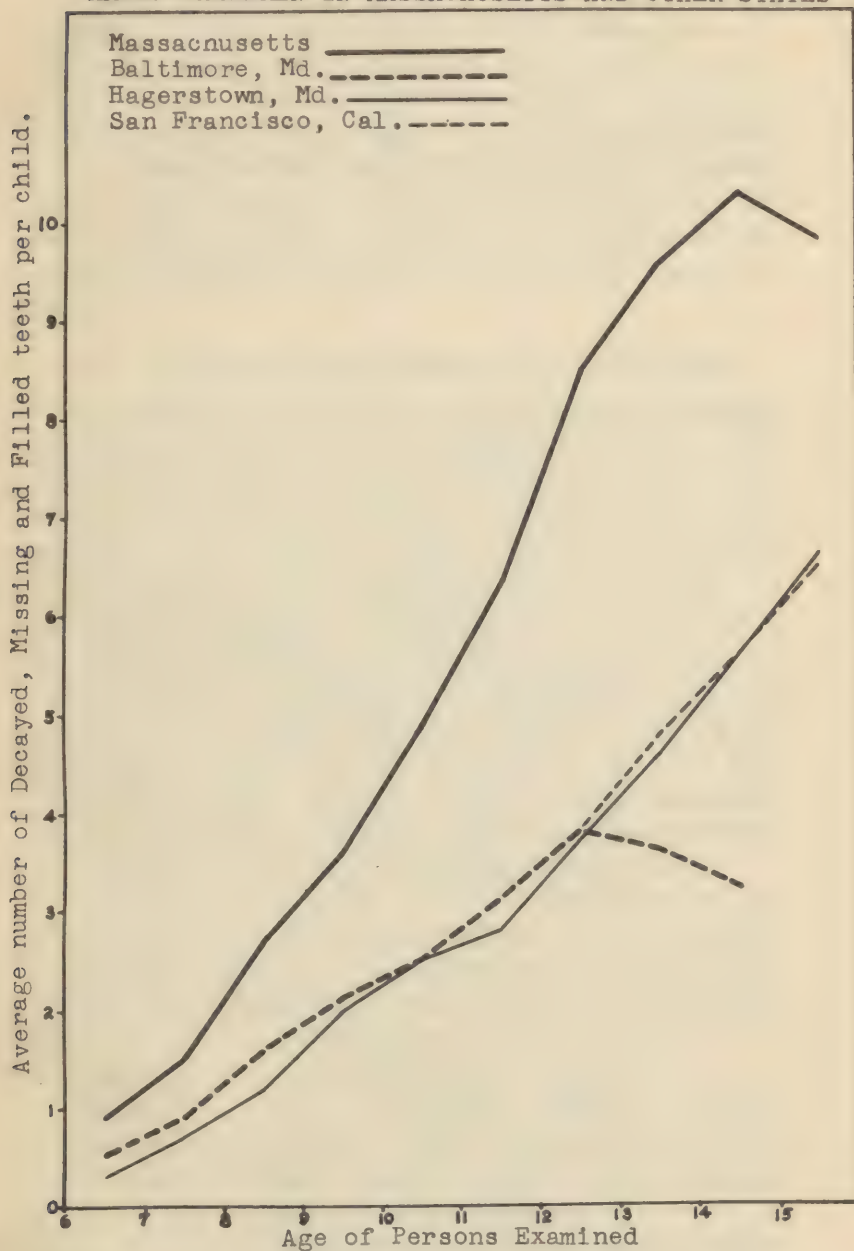
CITIES.	AVERAGE NUMBER OF DECAYED, MISSING AND FILLED TEETH PER CHILD AT AGE —									
	6	7	8	9	10	11	12	13	14	15
Massachusetts . . . . .	.9	1.5	2.7	3.6	4.9	6.4	8.5	9.6	10.3	9.8
Hagerstown, Md. . . . .	.3	.7	1.2	2.0	2.5	2.8	3.7	4.6	5.6	6.6
Baltimore, Md. . . . .	.5	.9	1.6	2.1	2.5	3.1	3.8	3.6	3.2	— <sup>1</sup>
San Francisco, Calif. . . . .	— <sup>1</sup>	— <sup>1</sup>	— <sup>1</sup>	— <sup>1</sup>	— <sup>1</sup>	— <sup>1</sup>	3.8	4.8	5.6	6.5

<sup>1</sup> No data available.*Dental Caries in Farnumsville.*

Last year attention was called to the fact that a small water supply in Farnumsville (Grafton) was the only one which contained as much as 1.0 part per million of fluorine. When children in the village were examined, it was found that their teeth were little better than those in towns where the fluorine content of the water supply was low.

In connection with a re-examination of the teeth of the children included in the surveys of last year, a special effort was made to explain why the dental caries rate was

COMPARISON OF DENTAL CARIES PREVALENCE  
AMONG CHILDREN IN MASSACHUSETTS AND OTHER STATES





not lower in Farnumsville. Of the 64 children examined in 1945, 31 were available for re-examination. Careful inquiry disclosed that only 3 of the children regularly used the water supply with the high fluorine content (1.2 p.p.m.). All of the others used water from private shallow wells or other supplies with low fluorine content. It is evident that the teeth of those using other supplies could not be expected to be less subject to caries and the small number actually using the water supply would not materially affect the average for the whole group examined.

#### NEW RESEARCH DEVELOPMENTS IN OTHER STATES.

In 1946, the Acting Director of the Division of Dental Health made a field trip to several States in order to gain first-hand information from Departments of Public Health and Universities with regard to other caries-control programs and research. A short trip was also made by Doctor Bibby, dental consultant of the Department. In addition, information was solicited from several States by personal communication and reports in the literature were followed. Comparison of the different research programs in the various States is important in aiding the Division in evaluating the possibilities of other new methods of caries prevention which may be adaptable to the dental public health program in Massachusetts. Following is a résumé of information accumulated:

*California.* — Dr. Becks and Dr. Wainwright of the California Dental College conclude from a study carried out by them that the action of sodium fluoride in caries control is to inhibit the action of enzymes produced by bacterial activity. They believe that the decay of teeth is caused by acids released by enzyme action.

*Connecticut.* — A. Dr. Erlenback, Director of the Bureau of Dental Health, reports that the private dental practitioner is being urged to apply sodium fluoride topically as a supplement to caries control.

B. The Bureau is distributing to the public a pamphlet entitled "How to Decrease Dental Decay by Sodium Fluoride Mouth Washes."

*Illinois.* — A. In Evanston a program of fluorination of public water supplies to decrease dental decay has been started. Last year the program was in the formative stage.

B. Dr. Fosdick of Northwestern University Dental School reports that commercial chewing gum fortified with calcium carbonate and Vitamin K reduced the occurrence of new cavities 60-90 per cent when chewed for at least ten minutes after each ingestion of food over a period of 18 months. This same gum with calcium carbonate but no Vitamin K reduced the occurrence of new cavities approximately half as much as Vitamin K gum. Since there were only 58 individuals in the first group and 45 in the second, further studies are needed to confirm these preliminary results.

C. Dr. Kesel of Illinois University Dental School reports that increasing the ammonia nitrogen in the oral cavity exerts a beneficial effect in preventing dental caries.

*Kansas.* — Dr. Kramer, Director of the Division of Dental Health, is carrying on a study on the use of topical application of 2 per cent sodium fluoride on children in very low fluorine areas.

*Michigan.* — It is reported in this State that a pilot program is being carried on in Sturgis regarding the time and cost of a public health dental care program.

*Minnesota.* — Dr. Jordan, Director of the Division of Dental Health, reports that in order to achieve maximum results in reducing the incidence of dental decay with topical applications of sodium fluoride solutions, the minimum number of treatments per annum needs to be four or more, but that more than eight treatments do not produce any marked additional effect.

*New Hampshire.* — Instructions in pamphlet form are to be distributed to the private dental practitioner concerning the method of topical applications of 2 per cent sodium fluoride to be used by the dentists.

*Ohio.* — A. A workshop in dental program planning will be conducted this year in Cleveland in December. The purpose of this will be to formulate a plan of action

to give children dental education and service in a more direct fashion than heretofore.

B. Dr. Hill of Western Reserve Dental College is experimenting in the use of penicillin to control caries. In a preliminary study in rats he reports a favorable result in preventing caries. His experiments with humans have not progressed far enough to be evaluated.

*Rhode Island.* — In Woonsocket under the co-operative action of the United States Public Health Service and the Bureau of Dental Hygiene of the Rhode Island Department of Health there is in progress a pilot program to determine the time and cost of dental care for children.

*West Virginia.* — Information concerning the topical application of 2 per cent sodium fluoride solution, as reported by Dr. Rumbel, Director of Dental Health, is being distributed to the private dental practitioner.

*Toronto, Canada.* — In co-operation with the University of Toronto, the town of Brantford is conducting a program in which sodium fluoride is being added to the water supply which is used by 3,000 children. This study is being correlated with similar studies at Timmons, where the fluorine in the water is low, and Stratford, where the natural fluoride content of the water is 1.2 p.p.m.

#### SUMMARY AND CONCLUSIONS.

The research projects which have been carried out in this State and others have brought us only slightly closer to a satisfactory solution of the prevention of dental caries. Some further confirmation of the usefulness of fluorine has been obtained but certain studies have failed to show favorable results. The best method for using fluorine has not yet been determined. The numerous studies which are in progress using the chemical in solutions applied directly to the teeth, in cleaning pastes, in dentifrices and in water supplies should give us further light upon this problem within the next two or three years. Not only has the best method of applying fluorine not yet been determined but we still must learn how long

the application must continue before maximum results occur. The most favorable results up to the present time have been obtained in children during the period in which teeth are erupting. Whether it will be necessary to continue the use of fluorine into adult life is yet to be decided.

Meanwhile, other substances which may have an influence in retarding the progress of dental caries are being studied, such as Vitamin K, indium nitrate, penicillin, the increasing of the ammonia nitrogen in the oral cavity, etc. There is no good reason to believe that a single element such as fluorine is the only substance which can be depended upon to produce beneficial results. All of the substances which appear to be effective should be studied thoroughly.

The Division would like to be in a position to recommend a procedure which can be depended upon to halt the progress of tooth decay, but the time has not yet come when this can be done. Studies must be continued to determine how satisfactorily procedures which appear to be effective in other States can be adapted to our dental health program in Massachusetts. Also, procedures which are found to be useful in well-controlled studies must be shown to be effective in the hands of casual users who cannot be depended upon to apply the measure with the same effectiveness as those who are specially trained.

There is reason to believe that we are much nearer to a satisfactory solution of caries prevention than we have ever been at any time in the past. The widespread interest in the problem and the numerous investigators who are attempting to make contributions in the field give us hope that much more effective dental health programs can be planned in the not too distant future.

Respectfully submitted,

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